The impact of governance on the electricity transition, based on a qualitative in-depth case study of the Netherlands, Denmark and Germany

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Abstract

There is great potential in the transition of the electricity system from fossil fuels to carbon neutrality or even zero-emissions to contribute to the larger energy transition. The Netherlands is one country that seems to have great potential to improve their electricity transition. Many academic publications show interest in optimizing policy instruments to improve the transition based on practices in different countries. There seems to be limited academic attention for governance practices, which in many academic fields is considered to be a level higher than policies. For policy instruments to work well, they must fit in the governance environment. This research identified four governance perspectives and conducted a qualitative in-depth case study to determine the impact of the different perspectives on the electricity transition in three cases: The Netherlands, Denmark and Germany. The results showed that for the current situation a controlling governance perspective may be the most suitable, supported by a cooperation based perspective. The electricity transition was found to be too immature for a market oriented perspective, but this may be an effective governance shift in the future, when the transition and especially the renewable technologies are more mature and competitive. Further research is needed to determine the role of the national context on the effectiveness of governance perspectives.

Key words: Electricity transition, governance, governance perspectives, case study.

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1 Introduction[1]

Climate change has become a widely accepted phenomenon globally. Many countries are focusing on their energy transition in order to contribute to the global fight against climate change. An energy transition is considered to be a fundamental structural change in the energy sector resulting in either carbon neutrality or zero-emissions (World Energy Council, 2014). Considering scientific literature, the Netherlands is a major player in the energy transition. Dutch authors have released many publications on the topic (Laes, Gorissen, & Nevens, 2014) and the Netherlands is a frequently used case study on the topic (Kemp, 2010; Kern & Smith, 2008). The Netherlands has emphasised the potential of the decarbonisation of the electricity sector, which is considered to be the 'low hanging fruit of the energy transition' (Dutch Ministry of Economic Affairs, 2016). This paper focuses solely on this specific sector, adopting Keenan's (2016) notion of the *electricity transition*.

The Netherlands is working hard to realise the national electricity transition, but is still lagging behind most other European countries, based on the percentage of renewables in the electricity fuel mix, as seen in Table 1.

Table 1: Percentage of electricity generated from RESe's, data retrieved from Eurostat (Eurostat, 2016).

Countries	2008 (%)	2014 (%)	Increase
EU average	17	27.5	62 %
Netherlands	7.5	10	33 %
Denmark	25.9	48.5	87 %
Germany	15.1	28.2	87 %

The Netherlands may still reach their national energy targets for 2020 and 2023, but it is evident that there is potential to improve the electricity transition. Most academic publications concerning the electricity transition focus on improvements on a policy instrument level. For the electricity transition many studies have been found which compare policy instruments within a case or between cases and aim to optimize them (D'Alessandro, Luzzati, & Morroni, 2010; Lo, 2015; James Meadowcroft, 2009; Nordensvärd & Urban, 2015; Pegels & Lütkenhorst, 2014; Rocco, 2016). The main academic focus seems to be on policies, much less so on governance. Governance is defined as "the intentional shaping of collective human behaviour by various means within various arrangements" (Cayford & Scholten, 2014, 4). It seems to be common logic that policy instruments must fit within the governance environment, which may be unique for every case. In that light this paper proposes that the notion of governance is underexposed in energy transition literature in general.

[1] This paper is based on findings from the Master Thesis of Jan Keenan for the Delft University of Technology, publicly defended on December 2nd 2016 in Delft, the Netherlands (Keenan, 2016).

Cayford and Scholten (2014) argue that there are multiple arrangements in governance, which are adopted in this thesis as governance perspectives. This paper hypothesises that different governance perspectives have different impacts on the electricity transition.

Considering the Netherlands as a case which has potential to further develop their electricity transition and Denmark and Germany as best practices within the EU concerning the percentage of renewables in the fuel mix (Table 1), the impact of governance on the electricity transition may be studied using these cases. The main research question is as follows:

What is the impact of different governance perspectives on the electricity transition based on the cases of the Netherlands, Denmark and Germany?

To answer this question an in-depth qualitative case study is conducted of the three cases. The results from the individual cases are compared in a comparative analysis in order to synthesise overall results on governance in the electricity transition.

The paper is structured as follows. Section 2 presents the literature study which is used to construct a theoretical framework, supporting the research. The research approach and methodology is discussed in section 3. Using the theoretical framework the results of the in-depth case studies are presented in section 0. Section 5 discusses the results of the comparative analysis, determining the impact of each of the governance perspectives in the academic field. Section 6 concludes the paper and answers the main research question.

2 Literature review and a theoretical framework synthesis

A theoretical framework is constructed to support the research. This section describes how the theoretical framework is synthesised from literature. It consists of two main elements: performance and governance, both in the electricity transition. These two elements are discussed prior to the final presentation of the framework.

2.1 Performance

To determine what the impact of governance on the electricity transition is we must be able to determine the transition performance. There is globally no finished electricity transition which may be used as a blue print to define important performance criteria. Even more so, in literature some authors (James Meadowcroft, 2009) challenge the use of parameters for desired transitions as stressed in the Transition Management approach (Rotmans, Kemp, & van Asselt, 2001). Meadowcroft (2009) argues that the parameters are prone to politics of change. However, this paper is of a descriptive nature, rather than normative like the Transition Management approach, making it less prone to politics. Also literature provides no other method to compare the cases rather than using predetermined criteria.

A literature review identified two sets of criteria: market criteria and transition criteria. The market criteria are quantitative criteria and they determine how the regular electricity market is affected by the electricity transition. They are based mainly on the traditional energy market goals: availability, acceptability/sustainability, affordability, and accessibility (the four As) (APERC, 2007; Kruyt, van Vuuren, de Vries, & Groenenberg, 2009), and derived by interpretation of the author. The four criteria are:

1) Electricity price (affordability, the lower the better).
2) Security of supply (availability, the lower the amount and lengths of blackouts the better).
3) Installed renewable capacity (accessibility, more renewable capacity reduces geopolitical risks concerning fossil fuels).
4) Carbon emissions per produced kWh (acceptability/sustainability, reducing the amount of carbon emissions per produced kWh increases sustainability of the economy, ceteris paribus).

The transition criteria are qualitative and determine how well the process of the transition is going. The criteria are:

5) Societal commitment (ECF, PBL, & CIEP, 2013; Laes et al., 2014) refers to involvement and attitude of multiple layers of society. These layers range from citizens to small, medium and large businesses. Aside from attitude and involvement how well people are informed is important as well.
6) Innovation (Laes et al., 2014) is a major part of the transition. This paper scopes the innovation criterion to innovation rollout. Technological innovations are not considered. Technological innovations are assumed to be so elaborate that it is desirable to conduct a separate study on the topic.
7) Stability (ECF et al., 2013) mostly refers to the market stability which is so important to investors. An absence of opportunism in combination with transparency and clarity in the market stimulate market stability. Long term goals and depoliticizing goals and strategies may contribute to stability in the electricity transition.
8) Sense of urgency (personally derived from the creation and communication of the COP 21 Paris Climate Change agreement) is strongly related to the duration of the transition. One of the most important drivers of the electricity transition is the fight against climate change. The COP 21 Paris agreement showed that the whole world acknowledges the urgency in this challenge. The urgency is such that the first ever global political agreement was reached.

2.2 Governance

The definition for governance provided in the introduction follows from the literature review where many different definitions for governance are found (Cayford & Scholten, 2014; Fukuyama, 2013; Kooiman, 2000; J Meadowcroft, 2007; Williamson, 2005). The definition of Cayford and Scholten (2014) seems to combine the essential elements of the definitions found in both the social and economic fields of science, very useful to apply on a socio-technical system like the electricity system (Scholten & Künneke, 2016). They define governance as follows:

"governance is the intentional but ubiquitous shaping and guiding of collective human behaviour by various means (negotiation, law... reward etc.) within various arrangements (government-oriented, market-oriented, community-oriented)" (Cayford and Scholten, 2014, 4).

This definition may be used as a stepping stone for this paper. The 'various arrangements' may be perceived as certain *governance perspectives*, which will be discussed later. Reflecting on our statement earlier, most research in electricity transitions is on policy instruments rather than on the governance environment, or the governance perspective. The 'various means' within the 'various arrangements' emphasise the importance of this relationship. The 'various means' are referred to as the *governance instruments* in this paper.

Cayford and Scholten (2014) provide some examples of how governance perspectives could differ. This paper proposes the synthesis of four new governance perspectives, based on multiple scientific backgrounds.

Hisschemöller, Bode, & van de Kerkhof (2006) have conducted a literature review on governance from a political perspective. They collected ideas from renowned economists like Olsson, Ezrahi, Schumpeter, and Galbraith to propose four governance perspectives along a public-private divide. Ménard (2012) (an institutional economist) proposed two governance perspectives, also along the same divide, but argued that all alternatives in between the two perspective be collectively called 'hybrids'. Provan and Kenis (2007) have a network economics background and proposed three perspectives, again along the public-private divide, with a third party governance option between the publicly led and privately led networks perspectives. Based on these findings four new governance perspectives were assembled to support the paper:

- The governance by competition perspective is founded in all three of the papers assessed. It proposes that the market is central in the transition. Demand and supply determine the speed and pathways of the transition. New technologies will only enter the market once they are completely competitive.
- The governance by control perspective proposes that one stakeholder controls the market, in this case it controls the transition. Provan and Kenis (2007) emphasise that for such a perspective to be successful clear and unambiguous shared goals are needed. This provides authority for a stakeholder to take control of the transition. This governance perspective is embedded in all three papers discussed.
- Governance by cooperation is all about the cooperation between stakeholders in order to overcome barriers and exploit opportunities. Knowledge, costs and support are shared among stakeholders to reach greater benefits. The governance by cooperation perspective is emphasised by Hisschemöller et al. (2006) and fits in Provan and Kenis' concept of third party governance, where the third party is a cooperation between stakeholders. Ménard (2012) does not identify specific governance perspectives between the two polar perspectives of control (private) and competition (public).
- Governance by innovation is possibly the most controversial perspective. Hisschemöller et al. (2006) emphasise a perspective in which innovations are stimulated to enter the market. It relies on the market to lead the market but acknowledges the importance of stimulating innovations for several reasons. The essence is that innovations need help to overcome the market entry barriers.

Theoretically one could expect to find one governance perspective in each country. In reality we can expect a mix of governance perspectives, probably with one predominant perspective. Ménard (2012) created a graph to visualise his governance perspective theory. The new governance perspectives are placed in that same graph in Figure 1, to show how they relate to each other. The placement and size of the spheres are indicatory and should not be perceived as exact, more as a rough sketch.

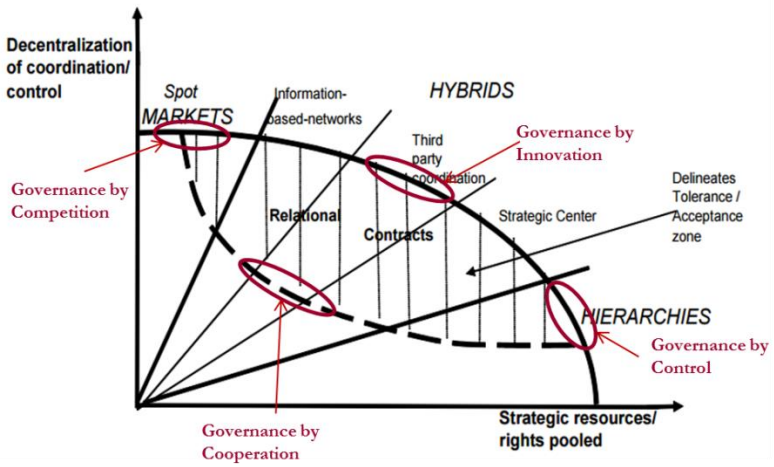

Figure 1: The new governance perspectives on Ménards axes. The locations of the new perspectives are placed roughly in the graph. The spheres of the perspectives should be seen as an indication, not definite demarcation.

2.3 Theoretical framework

The visualisation of the theoretical framework is presented in Figure 2. The governance perspectives are used to analyse the impact of governance on the transition performance. The criteria help determine the performance of the electricity transition and make the results comparable between the cases.

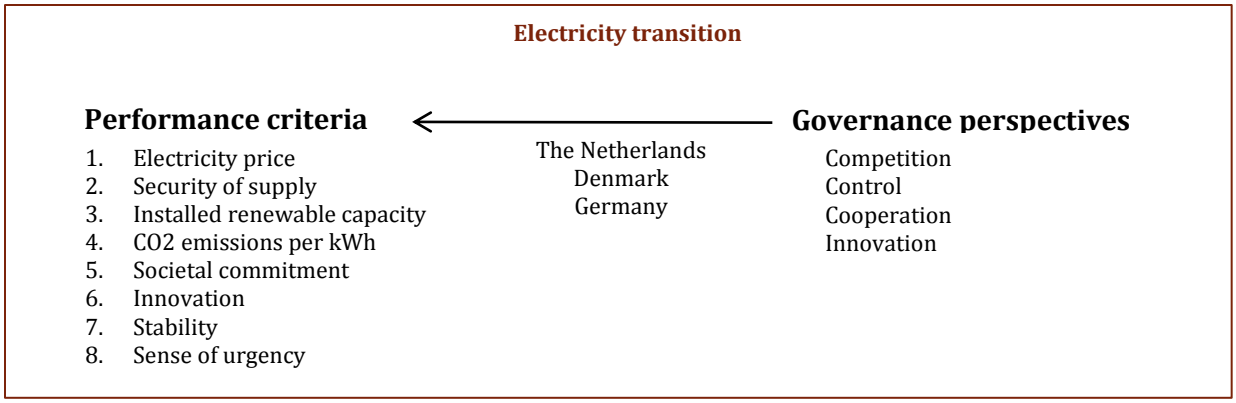

Figure 2: The theoretical framework which supports the research. The framework shows which steps are needed to undergo for each of the cases to answer the main research question.

Firstly the performance criteria are scored for each of the cases to determine the current situation. Then the impact of each governance perspective on each of the criteria for each case is determined. This is done by constructing a matrix with the governance perspectives (independent variables) on the x-axis and the criteria (dependent variables) on the y-axis. The resulting case specific matrices can be integrated into a larger overarching matrix, which may be used to compare the scores.

3 Methodology

This section presents the research approach. The operationalization of the most important concepts, the choice of research methods, case selection and the data collection and analysis are discussed.

3.1 Operationalization

The theoretical framework presents multiple notions which need to be operationalized before application is possible. Operationalization will reduce ambiguity of the approach, increasing repeatability and reproducibility of the research. The performance criteria and the governance perspectives are operationalized.

3.1.1 Operationalization of the performance criteria

The previous section proposed two sets of performance criteria. The first set consists of the quantitative market criteria. The operationalization of these criteria is relatively straight-forward and found in Table 2. The second set consists of qualitative transition criteria. The operationalization of these criteria is discussed after the market criteria.

Table 2: The market criteria are used to measure how well the market functions while it is in transition. The operationalization shows how the criteria are measured with the units in parenthesis.

Market criteria	Operationalization
Electricity price	Eurocent per kWh (ct.€/kWh)
Security of supply	Average time without electricity for consumers per year (min/year)
Installed renewable electricity capacity	MW
Carbon emissions	Carbon emissions per produced kWh (gCO2/kWh)

The transition criteria are of a qualitative nature and therefore harder to measure. The operationalization of these criteria is done is qualitative fashion. The criteria are summed up and briefly operationalized according to the author's interpretation of the notions.

- Societal commitment is determined by analysing the attitude of local businesses and citizens towards the electricity transition. This can be determined by the willingness to participate or contribute (e.g. pay high prices). Also, national surveys and other reports on attitude can show how committed society is to the transition.
- Innovation is operationalized by addressing the rollout of innovations to stimulate the transition. Innovation of technology (e.g. R&D) is not considered.
- Stability may be also named investment stability. Stability is affected by unforeseen changes in the market or opportunistic behaviour by players in a negative way. By providing transparency, clear goals and symmetric information in the market stability can be increased.
- The sense of urgency is directly related to the speed of the transition. The sense of urgency can be determined by communications from market players, the actual speed of the transition (depending on the goals), and the level of ambition of the transition targets.

3.1.2 Operationalization of the governance perspectives

To operationalize the governance perspectives, we refer to the definition of governance by Cayford and Scholten (2014). They spoke of the 'various means' within 'various arrangements'. The 'various arrangements' are the governance perspectives, the 'various means' are the governance instruments. A governance instrument is an instrument which is used to intentionally but ubiquitously shape behaviour in a system, based on the definition by Cayford and Scholten (2014). In the case of the electricity transition this could be anything from an energy or climate law to the creation of a cooperative to invest in renewable power generation. The governance instruments in place in each country may be found when conducting the in-depth case studies.

Table 3 shows how governance instruments can be labelled as one or multiple governance perspectives. The set of governance instruments determines the national governance perspective, which will probably consist of multiple theoretical governance perspectives, with one predominantly present.

Table 3: Operationalization of governance perspectives.

Governance perspective	Governance instruments
Governance competition	Tenders Any market-led instrument (e.g. the Dutch balancing mechanism) Focus on ETS Focus on international electricity market
Governance by control	Laws (Radical) Political decisions Tenders Transition surcharges Specific industry policy
Governance by cooperation	Societal agreements Cooperatives aimed at contributing to the transition Bottom-up initiatives or movements
Governance by innovation	Subsidy schemes Tax exemptions

3.1.3 Operationalization of the impact

The theoretical framework section mentioned that the governance perspectives and performance criteria are placed in a matrix. To determine each relationship an indicator is determined (found in Appendix B). Based on the indicators a score is attributed ranging from a strongly negative to a strongly positive impact ('--', '-', '0', '+', '++'). '0' Indicates that there is no significant impact of the governance perspective on that specific criterion.

3.2 Research methods

One method is the in-depth case study. Yin (1984, 23) defines the case study research as "an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used." Such a qualitative approach allows for a real understanding of the relationship between governance and transition in the cases. Subjectivity by the author is a risk with this method, therefore the findings are verified by experts. The case study results are compared by using the approach presented by Hoppe et al. (2016). The exact method is found in Appendix A and Appendix B.

3.3 Case selection

The electricity systems in EU countries have been strongly influenced by EU legislation. From the EU countries Denmark and Germany were chosen as the most useful cases for this research for several reasons. First, Denmark and Germany are politically useful cases for the Netherlands. They are often used to compare the Netherlands in politics. Denmark and Germany have a lot of accessible data and most data are available in English. For data gathering this saves a lot of time and effort. Denmark and Germany are relatively easily reachable, a benefit for conducting the interviews. Finally, fact is that the countries are economically, politically, and culturally relatively similar. Denmark and the Netherlands are also geographically relatively similar. 'Relatively' is important here, as the similarity is hard to quantify, but it is clear that these countries are more similar than for instance southern or eastern European countries to the Netherlands.

3.4 Data collection

The data is mostly collected through desk research. A lot of (semi) scientific literature is available for all three cases. Also many reports are published concerning the energy transition in totality in the three cases. As an addition to this relatively 'hard data' interviews have been conducted to add 'soft data'. This research has been executed at the Netherlands Ministry of Economic Affairs, which provided the opportunity to speak to many energy experts and use their networks.

Formal expert interviews were conducted towards the end of the research so aside from adding data, results could be verified. The duration of the interviews was around 60 minutes and were all in person, except for one, which was done via the Skype software. The list of interviewees and the interview structure are found in Appendix C.

3.5 Data analysis

The collected data is structured according to the layout of this paper. An overview of the data and how they are interpreted is found in Appendix A and B. The overview is the basis of the comparative analysis, which is based on repeated interpretation and analysis of the case study results. The data retrieved from the interviews are presented in summarising transcripts which are verified by the interviewees[2].

3.6 Limitations

Such a qualitative methodology has some risks and limitations. There is a risk of subjectivity from the author. This is reduced by expert verification, but the choice of experts is still the author's. To come to a more robust answer to the research question a regression analysis would have been suitable. However, data from three cases are insufficient for a valid regression analysis. The case selection will largely determine the results of the study. We may assume that completely different results would be found when studying countries like China, Brazil, or South-Africa for many reasons.

[2] The transcripts are attached to the main thesis report (Keenan, 2016).

4 Case studies

This section studies the performance and governance elements from the theoretical framework in each of the cases. They help to understand the results discussed in section 5.

4.1 Performance

The results of the in-depth case studies of the three countries are found in Appendix A. In accordance with the theoretical framework, the performances of the countries are briefly elaborated so we may later determine the impact of governance on the electricity transitions.

The electricity price in the Netherlands is relatively low, the security of supply is good, the carbon emissions are reducing and lower than in Germany, but the amount of installed renewable capacity is relatively limited. The societal commitment in the Netherlands seems to be lagging behind. There is especially a large NIMBY effect in the Netherlands, possibly because of the country's populous nature (Trouw, 2011). The commitment from businesses and industries is increasing and local initiatives are growing, but compared to Denmark and Germany there is limited commitment. There seems to be limited innovation rollout in the Netherlands, because of the cost-efficient approach. Market stability is increasing, as seen in the record-breaking bid for the new offshore wind farm at Borssele (Government of the Netherlands, 2016). This is, however, just one field in the electricity transition, stability in other fields like the solar PV market is still clearly lagging behind (het Parool, 2016). The Dutch approach does not emit a strong sense of urgency.

The Danish electricity transition is characterized by a homogeneous but expensive approach. Denmark has the lowest carbon emissions and a large installed renewable capacity. There is a real drive to be independent of fossil fuels and become a market leader in renewables, which has led to a strong societal commitment (Danish Governement, 2011; IRENA & GWEC, 2011). The market is stable, as the approach in the electricity transition has largely remained the same since it started in the seventies (IRENA & GWEC, 2011; Kemp, 2010). A relatively large amount of innovations has been rolled out in Denmark. There is a great sense of urgency in Denmark, as they are aiming to be (1) completely independent of fossil fuels and (2) want to exploit the first mover advantage.

The German transition is far less homogeneous than the Danish. The electricity price in Germany is very high as well, but the carbon emissions are a lot higher. This is because mostly nuclear rather than fossil fuel capacity has been replaced by renewable capacity (Agora Energiewende, 2015b; Energiewende, 2012). There is a great societal support in Germany to phase-out nuclear, which is the initial movement that led to the *Energiewende* (Brandt, 2006). However, Germany has a lot of lignite mines, so closing lignite plants has a direct impact on a national industry (DEBRIV, 2016; Nordensvärd & Urban, 2015; the Guardian, 2015). Germany has had a large rollout of innovations, financed by a surcharge on the electricity price (BMWi, 2014). The renewable energy sources law (EEG) in Germany including long term goals has created stability in the electricity transition (Podewils, personal communication, 2016). The nuclear phase-out was expected to have a negative impact on the stability, but this was not the case, because the action fitted within the long-term government strategy (Podewils, personal communication, 2016). To reduce costs a cap has been placed on renewable technologies growth in Germany, this has affected the sense of urgency negatively (Morris, 2016a).

4.2 Governance

Four governance perspectives were identified and used in the theoretical framework. This section discusses how each of these perspectives is present in the three countries.

4.2.1 Governance by competition

The governance by competition perspective is mostly seen in the Netherlands. The Dutch electricity transition governance can be characterized as strongly market oriented. Tenders have been used in the Netherlands for a long time. Since a couple of years, they are combined with the SDE+ for offshore wind farms. If a party wins the tender for an offshore wind farm, it is directly guaranteed the subsidy according to

the SDE+ scheme. It is an incentive for cost-efficient bids, stimulating competition on the bidding side. The Dutch balancing mechanism is primarily focused on the market (Frontier Economics, 2015). The market provides financial incentives for investments when more back-up capacity is needed. Also the fact that the Netherlands has explicitly decided to focus on the ETS (Dutch Ministry of Economic Affairs, 2016) is a market oriented choice. The Netherlands are anticipating on an international electricity market (TenneT, 2015, 2016) and have actively advocated it.

Denmark has adopted the same tender procedure (Energinet DK, 2016b). This process will guarantee that the most cost-efficient wind farms will be built, thus costs are reduced by competition. The Danish power market is currently connected to the Nordpool, the Nordic power market, an example of the international market orientation (Kitzing, Katz, Schröder, Morthorst, & Andersen, 2016). The investments in interconnectors with surrounding countries underline this intention as well (Energinet DK, 2016a; TenneT, 2016). An international market will stimulate international trade and competition in general.

Germany has recently made amendments to their Renewable Sources Act (EEG). The German Minister of Economy and Energy has declared it to be the first step towards the market for the electricity transition (BMWi, 2016). It is clear that the shift towards the market will be a future shift, the only market oriented element added to governance is the introduction of tender procedures (BMWi, 2016).

4.2.2 Governance by cooperation

The Dutch Energy Agreement showed that many market participants acknowledge the need to cooperate to successfully fulfil the transition (SER, 2013). The willingness to cooperate was clear. The energy dialogue was the next step after the energy agreement. The dialogue invited all sorts of people to the debate and to deliver input for the governance of the transition towards 2050. The Energy Agreement mostly focused on large branches, but did succeed in creating goals with shared problem ownership.

In Denmark local cooperatives (IRENA & GWEC, 2011) have driven both wind and grid investments and resulted in a boost for the power market. The cooperatives have not only resulted in physical improvements and investments; they have also involved the public in the transition of the power market. State of Green is a public-private partnership between government and industry associations (State of Green, 2016). This partnership brings together stakeholders to stimulate an efficient energy transition. By sharing knowledge and experiences and bringing like-minded parties together the energy transition will be stimulated.

The *Energiewende* in Germany started off as a movement derived from the anti-nuclear activists (Brandt, 2006). So, one could say that the current energy transition is a result of a bottom-up movement gaining influence and strength along the way. Now the Energiewende is a top-down phenomenon, but there is still bottom-up commitment, even though commitment seems to be in decline (Morris, 2016b; Spiegel, 2013; The New York Times, 2014). Local cooperatives have stimulated the growth of renewables (Brandt, 2006), and their participation has been stimulated by feed-in tariffs (Morris, 2016a). Investments in power generation and local grid expansions by cooperatives have caused the system to grow. The new EEG revisions could reduce the number of active cooperatives, as the risk of investing in pre-development and losing the tender is too great for small parties. The Renewables Made in Germany initiative from the BMWi aims to stimulate export of the renewable energy industry (Renewables Made in Germany, 2016). Renewable energy industry growth could lead to economic benefits.

4.2.3 Governance by control

The only form of governance by control found in the Netherlands is the tender scheme, which provides a tool for the government to control the growth and make sure that capacity goals are reached.

The Danish Energy Agreement is a political agreement. It ensures that transition targets remain fixed on the long term, outlasting cabinet terms. The government has created a shared goal between most political parties, thus binding most voters. Provan and Kenis (2007) emphasised the importance of a shared goal for this perspective to be successful. The independence of fossil fuels is a shared goal in Danish society, creating authority for one controlling entity: the central government. The Danish government has pushed the wind power industry and is renowned for it (IRENA & GWEC, 2011). There is a consensus that Denmark has a first mover advantage in wind technology. Most of the major players in the wind power industry are either Danish by origin or located in Denmark. Also Denmark has converted many CHPs from coal fired to biofuel fired plants, and closed many others as part of the fossil phase out (Chachah, personal communication, 2016). The government has always clearly stimulated the wind power technology and the involved industrial growth. Now Denmark has a promising position considering the expected future investments in wind power globally. Another controlling governance instrument is the tender procedure (Energinet DK, 2016b).

The aforementioned shift in governance by Germany has increased governance by control. The biggest change and the most noticable in this respect is the introduction of tender procedures and implementing (financial) caps on renewable technology growth (BMWi, 2016). The tenders provide the necessary control for the German government of the growth of renewables, as the grid could not cope with the actual growth of renewable technologies and the corresponding technological effects (Clean Energy Wire, 2015, 2016). The EEG is a legal act with renewable energy transition targets incorporated (BMWi, 2014). This is a strongly controlling mechanism, but the need to incrementally shift towards the market in the future was emphasised during the presentation of the recent amendments. The transition will be increasingly fit to be governed by the market (BMWi, 2016). The nuclear phase-out (Strunz, 2014) fits in a strongly shared societal goal: national safety. Such a non-market driven process will most likely lead to significant costs for society. However, the shared goal underlines the necessity.

4.2.4 Governance by innovation

The Dutch SDE+ scheme (RVO, 2016b) helps renewable technologies to enter the market. It has a competition element to it as the subsidies are awarded to the most cost-efficient bids for subsidy. But most of all it is an essential tool to help renewable technologies enter the market. The same goes for the 'salderingsregeling', which allows small scale solar PV power producers to subtract abundant generated power, which flows back to the grid, from their own electricity bill (RVO, 2016a). Without this scheme, small scale solar PV panels would not be profitable and would not enter the market.

The Danish government has used several instruments to stimulate innovation on the electricity market. One of them is the premium on top of the market price (Energinet DK, 2016b). This equals the variable cost of production minus the electricity price. The premiums provide the renewable technologies with the opportunity to enter the market and compete. They also offer feed-in tariffs to the winning offshore wind farms tender, similar to the Dutch SDE+ scheme (Energinet DK, 2016b). Danish financial support schemes have been financed by the Public Service Obligation (PSO) (Rathmann et al., 2009). This is a tax which is included in the electricity price. Grid expansions are also financed by the PSO. The PSO is a relatively high share of the electricity price, so it is also an incentive for energy conservation. Denmark has the a similar scheme to the Netherlands for small scale solar PV stimulation, which they call tax exemptions (Energinet DK, 2016b).

In Germany feed-in tariffs are used for small scale wind turbines and solar PV installations (<750 kW) (BMWi, 2016). Larger installations must compete in tenders before they are awarded a project. Depending on the offered project price of the winning tender a fixed feed-in tariff is determined, similar to the Dutch approach.

Table 4: An overview of the governance instruments labelled by governance perspective in the Netherlands

Theoretical perspectives	Dutch governance	Danish governance	German governance
Governance by competition	Tenders Market orientated balancing mechanism ETS focus Clear focus on the (international) market	Tenders Focus on international power markets (Nord & Baltic)	Tenders
Governance by cooperation	Energy Agreement Energy dialogue	State of Green Energy cooperatives	Cooperatives Renewables made in Germany Energiewende
Governance by control	Tenders	Energy Agreement Industry policy PSO Tenders	EEG (including goals) Nuclear phase-out Tenders / renewable capacity growth cap
Governance by innovation	SDE+ 'Salderingsregeling'	Premiums Tax exemptions Feed-in tariffs	Feed-in tariffs

5 Results and discussion

The previous section discussed the two elements of the theoretical framework for each country: electricity transition performance and the governance perspectives in the transition. This section discusses the results of the comparative analysis regarding the impact of the governance perspectives on the performance. Table 5 and Table 6 show the results of the comparative analysis in a structured fashion. The first-mentioned compares the transition performance of the three cases, the latter presents a comparison of the impact of the governance perspectives. As we saw earlier the governance perspectives of the cases differ from each other, as they consist of a unique set of governance instruments. This is one of the reasons why governance perspectives may score differently on certain criteria between cases. The argumentation and explicit analysis are found in Appendix A and Appendix B.

Governance by competition is mostly seen in the Netherlands. There are however clear shortcomings in that perspective. The most important is the fact that renewable technologies are not (yet) competitive. The perspective can be used effectively on some specific points like the Dutch balancing mechanism and tenders. However, this perspective does not yet seem to be ready to be a predominant perspective in the electricity transition.

The governance by control perspective is predominant in Denmark and German governance has recently shifted towards this perspective. From the four perspectives the governance by control perspective seems to have the largest potential. Looking at the three cases the only negative impact this perspective has is on the electricity price. The rest is solely positive. It also has a very wide impact, on many different criteria.

The governance by cooperation perspective does not have a very wide impact. The impact is solely positive, though. Governance by cooperation seems to be a very useful perspective to support the governance by control perspective. It helps to align governance with societal sentiments and initiatives. This is essential and should definitely not be underestimated. The importance is seen in examples like the German Energiewende movement itself, the local cooperatives wanting to participate in both Denmark and Germany, and the Dutch Energy Agreement, which all created shared ownership. The range of the impact of this perspective is however limited.

In the case of the electricity transition I argue that the governance by innovation perspective should be part of the governance by control perspective. Empirical research showed that in this system the same stakeholder drives both perspectives: the national government. The stimulation schemes found and taken into account in the cases are centrally coordinated by the national government and experience shows that the government is the logical stakeholder to take control of the transition. So in retrospect the governance by innovation perspective should have been part of the governance by control perspective. The innovation perspective is therefore not discussed further.

Table 5: Results of the comparative case study analysis of transition performance.

Performance criteria	The Netherlands	Denmark	Germany
Electricity price	+	--	--
Security of supply	+	++	-
Installed renewable electricity capacity	-	+	+
Carbon emissions	-	+	--
Societal Commitment	-	++	+
Innovation	-	+	+
Stability	+	++	+
Sense of urgency	-	++	+

Table 6: Results of comparative analysis showing the impact of governance perspectives on the perforamnce criteria

		Governance			
		Competition	**Control**	**Cooperation**	**Innovation**
Electricity price	NL	-	0	0	0
	DK	0	++	0	++
	DE	0	++	0	++
Security of supply	NL	++	0	0	0
	DK	+	++	0	0
	DE	-	++	0	-
Installed renewable capacity	NL	--	+	++	++
	DK	--	++	+	++
	DE	--	++	+	++
Carbon emissions	NL	++	-	-	-
	DK	++	--	-	--
	DE	++	0	0	0
Societal commitment	NL	0	0	+	+
	DK	0	++	+	++
	DE	0	0	++	+
Innovation	NL	--	0	0	++
	DK	--	0	0	++
	DE	--	0	0	++
Stability	NL	+	+	+	+
	DK	0	++	0	++
	DE	+	+	0	+
Sense of urgency	NL	-	0	0	+
	DK	0	++	+	++
	DE	-	-	0	+

Based on these findings I argue that the governance by control perspective has the most desired impact on the electricity transition. Some nuance needs to be added to this argument though. Germany has shown that governance is not necessarily static. They have recently shifted their governance and at the same time declared a future shift towards the market. This research has explicitly focused on the current situation and

future shifts in governance may be very useful. Especially if/when renewable technologies become competitive, governance by competition will become a more interesting governance option.

6 Conclusions

There is room for improvement in the Dutch electricity transition, especially compared to other EU countries based on the installed renewable capacity. Many academic publications show how countries could learn from other countries on a policy level. However, an absence of literature on the governance level was found concerning the energy transition in general. This paper proposes that such an approach may add useful knowledge to the extensive literature on policy in energy transitions. The main research question addressed was as follows:

What is the impact of different governance perspectives on the electricity transition based on the cases of the Netherlands, Denmark and Germany?

Four governance perspective have been identified: governance by competition, control, cooperation, and innovation. The impact of these perspectives on eight different electricity transition performance criteria were addressed for each case. The exact content of the governance perspectives in the different countries can differ, as they consist of a specific set of governance instruments. Comparing the results from each case allowed to determine the impact of the different perspectives in a more general fashion.

Governance by innovation was found to be a superfluous perspective in the case of the electricity transition. The concerning stakeholder in this perspective is the same as in the governance by control perspective: the national government. Therefore I argue that for the electricity transition there is no added value in distinguishing governance by innovation from governance by control. So governance by innovation is no longer considered.

The governance by control perspective seems to be the most adequate perspective to govern the electricity transition. It has a wide and positive impact. Governance by competition seems to be insufficient for now, as the renewable technologies are not (yet) competitive. The value of governance by competition could improve significantly in future phases of the transition. Governance by cooperation has a very positive but not so wide impact on the electricity transition. It seems to be a useful support for the governance by control perspective, as it helps to connect governance with societal initiatives and sentiments. It must be added that these findings reflect the current state of the electricity transition, and governance may need to be adapted as the transition progresses.

This research has focused on governance perspectives and governance instruments. Another approach could be to determine governance based on stakeholder analyses. By taking into account stakeholders more explicitly common challenges like strategic behaviour can be discussed and analysed. On the other hand, a helicopter view could be more difficult with such an approach, because stakeholders could apply strategic behaviour in the research itself as well. So these two methods both have their pros and cons.

One element of importance that has not been taken into account in this paper is the role of the national context. One of the criteria for the case selection was the similarity on many levels between the countries. However, there still may be significant differences between the cases. Meadowcroft (2009) stated for instance that governance is essentially political, so the influence of the political context could have a great influence on the effectiveness of governance in different countries. Laes et al. (2014) also identified political limitations to governance. This could lead to perspectives being successful in one case and less so in the others. More research is needed to determine the influence of the national context on governance.

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Appendix A: Performance results

Table 7: Results of comparative analysis of market criteria.

Market criteria	The Netherlands	Denmark	Germany
Electricity price	+	--	--
	Households: 19.9 ct.€/kWh	Households: 30.36 ct.€/kWh	Households: 29.13 ct.€/kWh
	Large scale industry: 6.6 ct.€/kWh	Large scale industry: 9.1 ct.€/kWh	Large scale industry: 9.5 ct.€/kWh
Security of supply	+	++	-
	23.4 min/year (Netbeheer Nederland, 2014)	16 min/year (The Danish Energy Agency, 2016)	12 min/year (Clean Energy Wire, 2015) The problems caused by the insufficient grid capacity are mostly experienced in surrounding countries.
Installed renewable electricity capacity	-	+	+
	5796 MW (CBS, 2014) 0.3 kW/capita	4931 MW wind (Agora Energiewende, 2015a). The CHPs are difficult to define. 1.0 kW/capita	83 GW (Agora Energiewende, 2015b) 1.0 kW/capita
Carbon emissions	-	+	--
	490 gCO2/kWh (European Environment Agency, 2016)	300 gCO2/kWh (European Environment Agency, 2016)	636 gCO2/kWh (European Environment Agency, 2016)

Table 8: Results of comparative analysis of transition criteria.

Transition criteria	The Netherlands	Denmark	Germany
Societal Commitment	-	++	+
	The societal commitment in the Netherlands does not yet seem to be strong. The need for commitment, especially from citizens, is essential in a populous country like the Netherlands. The commitment from businesses and industry is increasing, and there is a fair amount of local initiative. So, we can conclude that the commitment is not yet sufficient but it is growing.	The societal commitment is very strong in Denmark. It is more than forty years ago that Denmark started the energy transition to be independent of oil. This means many generations of Danish people have grown up in the transition and experience it as a reality rather than a political decision. It is seen in the involvement of the Danish people in wind cooperatives how citizen participation is essential in the transition. Currently resistance is increasing slightly against wind on land. However, with sufficient potential for offshore wind this growing resistance will not affect the transition significantly.	Most renewable power capacity is currently owned by local cooperatives. This goes to show how multiple levels of society are involved in the electricity transition. There is societal commitment to the Energiewende. However, one of the most controversial political debates is expected to start after the next elections: phasing out lignite. Practically all lignite burned in German power plants is mined in Germany itself. Many regions are strongly dependent on the mines and commitment to the Energiewende could deteriorate. The market participation of cooperatives in general is expected to drop following the 2016 EEG amendments, but so are the costs.
Innovation	-	+	+

	The focus is on the most cost-efficient technologies, not considering so much long-term potential of the technologies. This is a logical strategy, considering the Dutch primary focus on the market, where the most cost efficient party prevails.	The Danish government has explicitly chosen to stimulate national renewable energy industries. Now Denmark has a world leading wind power industry and knowledge. The PSO has been used to finance R&D leading to essential innovations.	Germany has one of the lowest solar PV costs in the world and have been a front runner in wind, solar and biomass power. They perceive the low costs to be the result of innovation. Now the government is focussing on connecting stakeholders in the renewable power industry to stimulate innovation further.
Stability	+	++	+
	The Dutch government does not have clear concrete long term goals. The energy report mentions that to reach 80% emission reduction in 2050 (the minimum) in Europe the electricity system should be carbon neutral. This implies that the Dutch electricity market should have zero emissions. However, a clear national goal has not been formulated and communicated, there is no clear narrative. The record-breaking tender for the offshore wind farms at Borssele show an improving picture of the Dutch investment climate. This is the result of transparent and stable governance. The announcement of possible alterations, by the Minister of EZ, to the salderingsregeling show how a lack of stability influences investments negatively.	A consensus among political parties creates stable governance. Although the path towards it could change, the goal will always remain the same. The fact that the goals are made explicit for the long term and the clear majority of politicians support these goals reduces the chance of governmental opportunism. A stable investment environment has led to a strong growth of the amount of renewable power and the national industry.	The national goals are embedded in national legislation: the EEG. This gives a stable outlook as the government is expected to reach these goals. However, the sudden nuclear phase-out and the amendments in the EEG have affected the stability negatively. Especially the nuclear phase-out shows that there is a risk of government opportunism in Germany.
Sense of urgency	-	++	+
	The fact that the Netherlands may only just realise their goals shows that there was no intrinsic sense of urgency. The aim for a limit of 1.5 degrees Celsius global temperature increase is said to only be realised with negative emissions. The Dutch governance has never officially made a statement about negative emissions. These factors show that there is currently no real sense of urgency from the Dutch government in the transition.	Since Denmark has been working on the transition for more than forty years, there is a very significant sense of urgency. Between 2001 and 2008 the growth in renewable power stalled temporarily as we saw in the history paragraph. The sense of urgency decreased and this resulted directly in an impasse. In 2008 however the Danish government revived the transition.	There seems to be a sense of urgency in the German transition. The fact that there are national energy goals for every ten years urges the transition to keep up to speed and not rely on a possible last minute sprint. On the other hand Germany has recently increased control of the quantity of new renewable power capacity. This is done to cope with the current grid, until necessary expansions have been completed. Limiting the amount of new renewable capacity does not show a great sense of urgency.

Appendix B: Results of comparative analysis

Table 9: The impact of the governance by competition perspective on the performance criteria.

Criteria	The Netherlands	Denmark	Germany
Electricity price	-	0	0
Indicator: share of the electricity price determined by the perspective.	There is a clear focus on the market determining the electricity price. The high switching rate ensures low prices.	The share of the electricity price determined by the market is small compared to other elements of the price.	The share of the electricity price determined by the market is small compared to other elements of the price.
Security of supply	++	+	-
Indicator: Impact of the perspective on the security of supply.	The balancing mechanism is based on the market and functions well. So, the security of supply is directly influenced by the market.	Interconnections when there is a profitable business case, they provide security supply in Denmark. This is an indirect impact.	Demand and production are far apart and the grid in between is insufficient currently. So, the market is failing slightly.
Installed renewable capacity	--	--	--
Indicator: The role of the perspective in renewable capacity growth.	The renewable technologies are not yet competitive on the market.	The renewable technologies are not yet competitive on the market.	The renewable technologies are not yet competitive on the market.
Carbon emissions	++	++	++
Indicator: How the perspective impacts the amount of carbon emissions.	Coal is the cheapest technology in the Netherlands, as well as the most polluting.	The reduction of carbon emissions has not been driven by the market. The market has a positive influence on carbon emissions.	Lignite is by far the cheapest and most polluting technology, even more so than black coal.
Societal commitment	0	0	0
Indicator: Role of the perspective in the societal commitment.	The free market has no direct impact on the societal commitment.	The free market has no direct impact on the societal commitment.	The free market has no direct impact on the societal commitment.
Innovation	--	--	--
Indicator: How the roll-out of innovation is affected by the perspective.	There are no innovations of significance which are competitive on the market (yet).	There are no innovations of significance which are competitive on the market (yet).	There are no innovations of significance which are competitive on the market (yet).
Stability	+	0	+
Indicator: How the perspective contributes to stability.	Stability is not great in the Netherlands, but there is a long-term market orientation which does create some stability.	There is limited market focus in Denmark and there is no clearly identifiable effect on stability.	Germany is going to focus more on the market on the long term. This long-term focus will benefit stability.
Sense of urgency	-	0	-
Indicator: The impact of the perspective on the sense of urgency.	Focus on the market seems be perceived as a passive approach, not showing a sense of urgency.	There is no clear focus on the market, so it is hard to say whether this perspective has any real impact.	The shift towards market has led to reactions insinuating that Germany's sense of urgency is declining.

Table 10: The impact of the governance by control perspective on the performance criteria.

Criteria	The Netherlands	Denmark	Germany
Electricity price	0	++	++
Indicator: share of the electricity price determined by the perspective.	The share of taxes and transition surcharges are relatively low in the Netherlands.	The share of taxes and transition surcharges is very high.	The share of taxes and transition surcharges is very high.
Security of supply	0	++	++
Indicator: Impact of the perspective on the security of supply.	There balancing mechanism is based on market, not control.	The main reason for the energy transition in Denmark is security of supply. The entire transition is subject to strong control.	The government has no taken control of the growth of renewables to assure security of supply by investing in grid expansions.
Installed renewable capacity	+	++	++
Indicator: The role of the perspective in renewable capacity growth.	The Dutch government uses tenders for large scale renewable technologies, controlling growth.	Denmark has clearly focused on wind power industry, for instance in the political agreement. This has stimulated the growth of wind power capacity greatly. Also, Denmark uses tenders.	The growth of renewable technologies is now strongly controlled by the government by tenders and growth windows (EEG).
Carbon emissions	+	++	0
Indicator: How the perspective impacts the amount of carbon emissions.	By using tenders the amount of renewables is increased, decreasing carbon emissions.	The carbon emissions have been reduced by closing fossil fuel plants or switching them to biomass.	Mostly nuclear power has been replaced by renewables and not so much fossil fuels. So, there has not yet been a great impact on carbon emissions.
Societal commitment	0	++	0
Indicator: Role of the perspective in the societal commitment.	There is very little impact on societal commitment.	There is a clear story that Denmark will profit economically from the first mover advantage, creating societal commitment.	There is very little impact on societal commitment.
Innovation	0	0	0
Indicator: How the roll-out of innovation is affected by the perspective.	Innovations mostly come about through financial stimulations, not so much control.	Innovations mostly come about through financial stimulations, not so much control.	Innovations mostly come about through financial stimulations, not so much control.
Stability	+	++	+
Indicator: How the perspective contributes to stability.	Tenders create some stability, especially as they usually fit in a tender scheme which provides clarity for a longer period.	Denmark has been clear about focusing on wind power (industry) and this has created stability. Even more so, the political agreement creates political stability.	Germany's nuclear phase-out provided stability for the long term.
Sense of urgency	0	++	-
Indicator: The impact of the perspective on the sense of urgency.	The Netherlands does not show strong controlling governance; thus, it does not have a clear impact.	Denmark has nearly always showed a clear sense of urgency as it is willing to spend money to be successful in the transition in a relatively short amount of time.	Although the government has taken control of the renewable technologies growth, it is not beneficiary for the sense of urgency, as it limits growth.

Table 11: The impact of the governance by cooperation perspective on the performance criteria.

Criteria	The Netherlands	Denmark	Germany
Electricity price	0	0	0
Indicator: share of the electricity price determined by the perspective.	The cooperation perspective has no influence on the electricity price.	The cooperation perspective has no influence on the electricity price.	The cooperation perspective has no influence on the electricity price.
Security of supply	0	0	0
Indicator: Impact of the perspective on the security of supply.	There is no clear link between cooperation governance and the security of supply.	There is no clear link between cooperation governance and the security of supply.	There is no clear link between cooperation governance and the security of supply.
Installed renewable capacity	++	+	+
Indicator: The role of the perspective in renewable capacity growth.	The energy agreement has set specific goals for the amount of installed capacity.	Local cooperatives have invested in renewable capacity from the beginning of the transition.	Local cooperatives have invested in renewable capacity from the beginning of the transition.
Carbon emissions	-	-	0
Indicator: How the perspective impacts the amount of carbon emissions.	The reduction of carbon emissions is partly the result of the energy agreement.	Local cooperatives have contributed to the growth of renewables and corresponding decline of carbon emissions.	Renewables have replaced nuclear, so the emissions are not affected.
Societal commitment	+	+	++
Indicator: Role of the perspective in the societal commitment.	The energy agreement has increased societal commitment slightly.	The involvement of local cooperatives has benefited the societal involvement.	The Energiewende is originally a citizen initiative. Also, the involvement of local cooperatives has benefited the societal involvement.
Innovation	0	0	0
Indicator: How the roll-out of innovation is affected by the perspective.	The rollout of innovation is not strongly affected by cooperation.	The rollout of innovation is not strongly affected by cooperation.	The rollout of innovation is not strongly affected by cooperation.
Stability	+	0	0
Indicator: How the perspective contributes to stability.	The energy agreement has created some stability, seen by the record breaking offshore wind power tender.	No clear contribution.	No clear contribution.
Sense of urgency	0	+	0
Indicator: The impact of the perspective on the sense of urgency.	There is no observable impact.	A political agreement shows a sense of urgency from politics.	There is no observable impact.

Table 12: The impact of the governance by innovation perspective on the performance criteria.

Criteria	The Netherlands	Denmark	Germany
Electricity price	0	++	++
Indicator: share of the electricity price determined by the perspective.	The impact on the electricity price is negligible.	High transition surcharges are used, among others, for financial stimulations schemes.	The wholesale price is extremely low. However, this only increases the subsidy amounts. The EEG surcharge accounts for a large share.
Security of supply	0	0	-
Indicator: Impact of the perspective on the security of supply.	No clear impact.	No clear impact.	Feed-in tariffs have led to strong growth of renewable technologies. The grid could not handle this growth, potentially challenging security of supply.
Installed renewable capacity	++	++	++
Indicator: The role of the perspective in renewable capacity growth.	Subsidy schemes have had great impact on the growth of renewable capacity.	Subsidy schemes have had great impact on the growth of renewable capacity.	Subsidy schemes have had great impact on the growth of renewable capacity.
Carbon emissions	-	--	0
Indicator: How the perspective impacts the amount of carbon emissions.	The corresponding increase of renewables has led to a slight decrease of carbon emissions.	The corresponding increase of renewables has led to a strong decrease of carbon emissions.	The renewable capacity replaced nuclear. So, no impact on carbon emissions.
Societal commitment	+	++	+
Indicator: Role of the perspective in the societal commitment.	The 'salderingsregeling' has affected societal commitment as it turns consumers to prosumers and created a business case.	From the start of the transition a business case was created to stimulate public participation. This has strongly affected societal commitment.	The shift from feed-in tariffs to tenders has negatively affected participation by cooperatives. However, there is still a business case for public participation on small scale.
Innovation	++	++	++
Indicator: How the roll-out of innovation is affected by the perspective.	The stimulation schemes are very important to stimulate the rollout of innovations.	The stimulation schemes are very important to stimulate the rollout of innovations.	The stimulation schemes are very important to stimulate the rollout of innovations.
Stability	+	++	+
Indicator: How the perspective contributes to stability.	The offshore wind power sector shows stability, the small scale solar PV shows less stability, with regulatory uncertainties.	The regulatory framework for stimulating renewables has been very stable in Denmark.	The effect of the new stimulation schemes is not clear yet. But stimulation schemes overall have been stable.
Sense of urgency	+	++	+
Indicator: The impact of the perspective on the sense of urgency.	The amount of money invested in stimulation schemes is relatively modest, but does show some sense of urgency.	Large investments in stimulation schemes show great sense of urgency.	More modest financial investments in stimulation schemes shows lower sense of urgency, but it is not gone.

Appendix C: Overview of experts and interview setup

Table 13: Overview of the interviewed representatives of involved stakeholders in the energy transition.

Expert name	Country	Organisation
Jasper Vis	The Netherlands	DONG Energy (Energy company)
Carsten Chachah	Denmark	Dansk Energi (Representatives of Danish energy industry)
Anders Kofoed-Wiuff	Denmark	EA Energieanalysis (Energy consultancy)
Rasmus Zink Sörensen	Denmark	Danish Energy Agency (Policy executing agency for the ministry of Economic Affairs)
Joachim Hein & Dennis Rendschmidt	Germany	BDI (Industry representatives)
Christof Podewils	Germany	AGORA Energiewende (Energy transition think-tank)
Max Rathmann	Germany	BMWi (German Ministry of Economic Affairs)
Anonymous (Department head)	Germany	Wirschaftsrat (German Business Association)

Table 14: Overview of the interviewed academic experts.

Expert name	Country	Expertise
Jos Notenboom	The Netherlands	Originally a biologist with experience in research on the Dutch energy transition, among others performing case studies on policy tools in Germany and other European countries for PBL (The Netherlands Environmental Assessment Agency).
Gert Brunekreeft	Germany	Professor in energy economics at Jacobs University in Bremen.

Table 15: Interview elements and their contribution to the research.

Elements discussed in interview	Relation to theoretical framework	What these elements contribute
Current drivers and barriers.	Performance criteria	This element showed the political perspective of the experts on the transition. The experts showed what they think is important in the transition and how well the transition is going according to them.
Key performance indicators.	Performance criteria	By addressing the key performance indicators according to the experts, the chosen criteria were verified. If one or some of the chosen criteria were not mentioned by the experts, their opinions were asked before moving on to the following element.
How *case at hand* scores on these indicators.	Transition performance	This element allowed to discuss the transition performance, structured by the performance criteria. The aim here was specially to derive information about the transition criteria, which are qualitative by nature. The interpretations of data from (semi) scientific literature were also verified discussing this element.
Which governance instruments are successful, which are not and why this is.	Governance instruments	After a short introduction about the concept of governance instruments the experts provided useful insights on the impact of instruments and why they are (not) successful. It verified the data found from the market analyses and how the instruments were interpreted. If any key instruments were missed previously they could be found through the interviews.
Whether governance is predominantly based on market, cooperation, innovation or control.	Governance perspectives	This element addressed the step in the theoretical framework to determine the national governance perspective based on the instruments. Labelling the instruments as (a) certain perspective(s) was purely based on interpretation. Discussing the national governance perspective allowed to verify that process and the results.

Reflection on findings	Impact governance on performance	Here I presented the findings from the literature review to the experts. This interview element allowed to verify results and understand possible shortcomings, which are mostly discussed in the reflection chapter.